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Abstract

Two experiments were conducted to determine the effect of feeder adjustment and diet form on growth performance of nursery pigs. In Exp. 1, a total of 210 nursery pigs (PIC 1050 Ã— 327, initially 26.2 lb BW) were used in a 21-d trial. In Exp. 2, a total of 1,005 nursery pigs (Fast Ã— PIC sows Ã— TR4 boars, initially 31.1 lb BW) were used in a 28-d trial. Treatments in both experiments were arranged as 2 Ã— 3 factorials with main effects of feeder adjustment and diet form. The 2 feeder adjustments consisted of a narrow feeder adjustment (minimum gap opening of 0.50 in.) and a wide adjustment (minimum gap opening of 1.00 in.). The feeders were adjusted to the minimum gap setting, but the agitation plate could be moved upward to a maximum gap opening of 0.75 or 1.25 in, respectively. The 3 diet forms were meal, poor-quality pellets (70% pellets and 30% fines), and screened pellets with minimal fines. Pigs were weighed weekly to calculate ADG, ADFI, and F/G.; Swine Day, Manhattan, KS, November 15, 2012

Keywords

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Effect of Diet Form and Feeder Adjustment on Growth Performance of Nursery Pigs[1,2]

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Summary

Two experiments were conducted to determine the effect of feeder adjustment and diet form on growth performance of nursery pigs. In Exp. 1, a total of 210 nursery pigs (PIC 1050 × 327, initially 26.2 lb BW) were used in a 21-d trial. In Exp. 2, a total of 1,005 nursery pigs (Fast × PIC sows × TR4 boars, initially 31.1 lb BW) were used in a 28-d trial. Treatments in both experiments were arranged as 2 × 3 factorials with main effects of feeder adjustment and diet form. The 2 feeder adjustments consisted of a narrow feeder adjustment (minimum gap opening of 0.50 in.) and a wide adjustment (minimum gap opening of 1.00 in.). The feeders were adjusted to the minimum gap setting, but the agitation plate could be moved upward to a maximum gap opening of 0.75 or 1.25 in, respectively. The 3 diet forms were meal, poor-quality pellets (70% pellets and 30% fines), and screened pellets with minimal fines. Pigs were weighed weekly to calculate ADG, ADFI, and F/G.

In Exp. 1 (d 0 to 21), no differences ($P > 0.13$) were observed in ADG, ADFI, or F/G among pigs fed from feeders with different adjustment settings. Surprisingly, pigs fed the meal diet had increased ($P < 0.001$) ADG and ADFI compared with pigs fed the 70% pellets + 30% fines or screened pellets. Pigs fed screen pellets had improved ($P < 0.004$) F/G compared with pigs fed meal or 70% pellets + 30% fines. In Exp. 2 (d 0 to 28), pigs fed from the wide feeder adjustment had increased ($P < 0.03$) ADG and ADFI. There was no difference ($P > 0.70$) in F/G among pigs fed from the different feeder adjustments. Pigs fed screened pellets or 70% pellets + 30% fines had increased ($P < 0.03$) ADG compared with pigs fed the meal diet. No difference ($P > 0.25$) in ADFI was observed among pigs fed different diet forms. Similar to Exp. 1, pigs fed screened pellets had improved ($P < 0.01$) F/G compared with pigs fed meal or 70% pellets + 30% fines. The combined results suggest that feeding nursery pigs from a wide feeder gap may provide benefits in ADG and ADFI with no negative effects on F/G. An improvement in F/G was observed only in pigs fed the screened pellets; therefore, the percentage of fines in the diets must be minimized to obtain maximum benefits to feed efficiency from pelleting.

Key words: diet form, feeder adjustment, pellet, nursery pig

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[1] Appreciation is expressed to Hubbard Feeds Inc., Mankato, MN, for providing feed and manufacturing services.

[2] Appreciation is expressed to New Fashion Pork for use of pigs and facilities.

[3] Hubbard Feeds Inc. (Mankato, MN).

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Introduction

Past research at Kansas State University has demonstrated that proper feeder gap adjustment plays an important role in decreasing feed wastage and improving F/G in growing-finishing pigs; however, the majority of the available research on feeder adjustment has been conducted using meal diets. The experiments also found that tight feeder adjustment reduced growth rate, particularly for pigs housed in field conditions. In addition, pelleting diets has been shown to improve F/G, but the magnitude of improvement is influenced by pellet quality and the percentage of fines. With increases in the cost of cereal grains, the impact of improving feed efficiency is becoming a more critical area of interest. More research is required to optimize feed efficiency and determine the relationship between feeder gap adjustment and diet form; thus, the objective of these experiments was to determine the effects of feeder adjustment and diet form on growth performance of nursery pigs.

Procedures

The K-State Institutional Animal Care and Use Committee approved the protocol used in these experiments. Experiment 1 was conducted at the K-State Swine Teaching and Research Center in Manhattan, KS, and Exp. 2 was conducted at a commercial nursery research facility in Iowa.

In Exp. 1, a total of 210 nursery pigs (PIC 1050 × 327, initially 26.2 lb BW) were used in a 21-d trial with 7 pigs were pen and 5 pens per treatment. All pens (4 ft × 5 ft) contained a 4-hole, dry self-feeder and a nipple waterer. In Exp. 2, a total of 1,005 nursery pigs (Fast × PIC sows × TR4 boars, initially 31.1 lb BW) were used in a 28-d trial, with 25 pigs per pen and 7 pens per treatment.

Similar diets and procedures were used in both experiments. Pens were randomly allotted to 1 of 6 experimental treatments. Treatments were arranged in a 2 × 3 factorial with the main effects of feeder adjustment and diet form. The 2 feeder adjustment treatments consisted of a narrow feeder adjustment (minimum gap opening of 0.50 in.) and a wide adjustment (minimum gap opening of 1.00 in.). The feeders were adjusted to the minimum gap setting, but the agitation plate could be moved upward to a maximum gap opening of 0.75 or 1.25 in., respectively. The 3 diet form treatments consisted of meal, poor-quality pellets (70% pellets and 30% fines), and screened pellets with minimal fines. Diets for both experiments were corn-soybean meal–based with 20% DDGS and were formulated to contain identical ingredient compositions within each experiment (Table 1). All pigs were provided with ad libitum access to feed and water. Pigs and feeders were weighed on d 0, 7, 14, 21, and 28 to calculate ADG, ADFI, and F/G. Pictures were taken of feeder pan coverage on d 21 or 28 for Exp. 1 and 2, respectively, then scored by a panel of 5 evaluators for percentage of pan coverage.

Diets were prepared and pelleted at the K-State Grain Science Feed Mill and Hubbard Feeds in Atlantic, IA, for Exp. 1 and 2, respectively. In accordance with the capabilities of each feed mill, the desired level of fines in the poor-quality pellets were created by 2 different methods. For Exp. 1, pellets were manufactured and screened to remove and collect fines. After the screened pelleted diet was bagged, the fines were added back to the remaining pellets. The mixture of pellets and fines was then added to the mixer, and additional fines were created in the mixer by mechanical breakdown. For Exp. 2, the pellets were passed through the roller mill, rather than the mixer, to create the additional fines.

Feed samples were taken at the feeder and pooled throughout the entire trial. At the end of the experiment, a composite feed sample for each phase was measured for percentage of fines in the pelleted diet. Fines were characterized by material that would pass through a #6 sieve (3,360 μm openings).

Experimental data were analyzed as a completely randomized design using the PROC MIXED procedure of SAS (SAS Institute, Inc., Cary, NC) with pen as the experimental unit. Treatments were arranged as a 2 × 3 factorial with 2 feeder adjustments and 3 diet forms. Differences between treatments were determined using the PDIFF statement in SAS. Significant differences were declared at $P < 0.05$ and trends at $P < 0.10$.

Results and Discussion

Experiment 1

The narrow feeder adjustment pan coverage scores for the meal, poor-quality pellets, and screened pellets diets were 42, 46, and 37%, respectively (Table 2). Representative pictures of mean pan coverage score are listed in Figures 1, 2, and 3, respectively. The wide feeder adjustment pan coverage scores averaged 92, 98, and 93% for the meal, poor-quality pellets, and screened pellets diets, respectively (Figures 4, 5, and 6, respectively). When percentage fines were measured, the poor-quality pellets contained 67% pellets and 33% fines, whereas the screened pelleted diet was 97% pellets and 3% fines (Table 3).

No interactions ($P > 0.19$) were detected between feeder gap adjustment and diet form for pig performance (Table 4). Overall (d 0 to 21), no differences ($P > 0.13$) were observed in ADG, ADFI, or F/G between pigs fed from feeders with the different adjustment settings (Table 5). Pigs fed the meal diet had increased ($P < 0.001$) ADG and ADFI compared with pigs fed the 70% pellets + 30% fines or screened pellets (Table 6). Pigs fed screened pellets had improved ($P < 0.004$) F/G compared with pigs fed meal or poor-quality pellets.

Experiment 2

The narrow feeder adjustment pan coverage scores for the meal, poor-quality pellets, and screened pellets diets were 52, 61, and 57%, respectively (Figures 7, 8, and 9, respectively). The wide feeder adjustment pan coverage scores were 98, 99, and 97% for the meal, poor-quality pellets, and screened pellet diets, respectively (Figures 10, 11, and 12, respectively). When percentage fines were measured, the poor-quality pellets contained 64% pellets and 37% fines, whereas the screened pelleted diet was 95% pellets and 5% fines.

No interactions ($P > 0.10$) were observed between feeder gap adjustment and diet form for pig performance (Table 7). Overall (d 0 to 28), pigs fed from the wide feeder adjustment had increased ($P < 0.03$) ADG and ADFI (Table 8). Feed efficiency did not differ ($P > 0.70$) among pigs fed from the different feeder gap adjustments. Pigs fed screened pellets or poor-quality pellets had increased ($P < 0.03$) ADG compared with pigs fed the meal diet (Table 9). No difference ($P > 0.25$) in ADFI was observed among pigs fed different diet forms. Similar to Exp. 1, pigs fed screened pellets had improved ($P < 0.01$) F/G compared with pigs fed meal or poor-quality pellets.

In Exp. 1, no difference was detected in ADG or ADFI between pigs fed from different feeder adjustments; however, in Exp. 2, pigs fed from the wide feeder gap adjustment had increased ADG and ADFI. For F/G, both experiments agree that feeder adjustment did not significantly influence feed efficiency; therefore, the combined results suggest that feeding nursery pigs from a wide feeder gap may provide benefits in ADG and ADFI with no negative effects on F/G. These results were unexpected, because the feeder pan was almost completely covered with the wide feeder adjustment and feed wastage was expected. With feeders used in this experiment, excessive feed in the pan did not appear to result in additional feed wastage.

For unknown reasons, pigs fed the meal diet in Exp. 1 had increased ADG and ADFI compared with pigs fed both pelleted diets. In contrast, pigs fed the meal diet in Exp. 2 had decreased ADG and ADFI relative to pigs fed the pelleted diets. Despite the differences in ADG and ADFI, both experiments agree that an improvement in F/G was observed only in pigs fed diets with screened pellets and not with the poor-quality pellets; thus, to obtain maximum benefits in feed efficiency from pelleting, the percentage of fines in the diets must be minimized.

Table 1. Diet composition (as-fed basis)

Item	Exp. 1	Exp. 2
Ingredient, %		
Corn	42.78	48.26
Soybean meal (46.5% CP)	30.95	27.10
Dried distillers grains with solubles	20.00	20.00
Soybean oil	3.00	---
Choice white grease	---	1.30
Monocalcium phosphate (21% P)	0.60	0.60
Limestone	1.25	0.87
Salt	0.35	0.50
Trace mineral premix	0.15	0.075
Vitamin premix	0.25	0.030
Copper sulfate	---	0.066
L-lysine HCl	0.375	0.402
DL-methionine	0.060	---
Methionine hydroxyl analog	---	0.120
L-threonine	0.070	0.092
Phytase[1]	0.165	0.040
Antibiotic[2]	---	0.400
AMMO curb[3]	---	0.100
Total	100	100
Calculated analysis		
Standardized ileal digestible (SID) amino acids, %		
Lysine	1.30	1.20
Isoleucine:lysine	64	62
Leucine:lysine	146	141
Methionine:lysine	33	34
Met & Cys:lysine	58	58
Threonine:lysine	62	62
Tryptophan:lysine	17.6	18
Valine:lysine	73	73
Total lysine, %	1.50	1.35
ME, kcal/lb	1,573	1,501
CP, %	23.9	21.9
Ca, %	0.71	0.68
P, %	0.60	0.59
Available P, %	0.43	0.31

[1] For Exp. 1, Phyzyme 600 (Danisco Animal Nutrition, St. Louis, MO) provided 450 phytase units (FTU)/lb, with a release of 0.13% available P. For Exp. 2, Natuphos 2500 (BASF Corporation, Florham Park, NJ), provided 450 FTU/lb, with a release of 0.13% available P.

[2] Chlortetracycline (CTC-50).

[3] Propionic acid-based mold inhibitor (Kemin Industries Inc., Des Moines, IA).

Table 2. Analysis of pan coverage (Exp. 1 and 2)

	Maximum feeder gap opening					
	0.75 in.			1.25 in.		
Item	Meal	70% pellet + 30% fine	Screened pellet	Meal	70% pellet + 30% fine	Screened pellet
Pan coverage, %[1]						
Experiment 1	42	46	37	92	98	93
Experiment 2	52	61	57	98	99	97

[1] Pictures were taken of feeder pan coverage on d 21 and 28 for Exp. 1 and 2, respectively. The feeder pan pictures were then scored by a panel of 5 for percentage of pan coverage.

Table 3. Analysis of percentage fines of pelleted diets (Exp. 1 and 2)[1]

Item	50% pellet + 50% fine	Screened pellet
Percentage fines[2]		
Experiment 1	33	3
Experiment 2	37	5

[1] Feed samples were taken at the feeder and pooled throughout the entire trial.
[2] Fines were characterized as material that would pass through a #6 sieve (3,360 μm openings).

Table 4. Effect of diet form and feeder adjustment on nursery pig growth performance, Exp. 1[1]

	Maximum feeder gap opening								
	0.75 in			1.25 in				Probability, $P<$[2]	
	Meal	70% pellet + 30% fine	Screened pellet	Meal	70% pellet + 30% fine	Screened pellet	SEM	Diet form[3]	Narrow vs. wide
d 0 to 21									
ADG, lb	1.35	1.31	1.30	1.43	1.30	1.31	0.021	0.001	0.13
ADFI, lb	2.00	1.92	1.86	2.13	1.93	1.87	0.043	0.001	0.18
F/G	1.49	1.47	1.43	1.50	1.48	1.43	0.021	0.004	0.73
Weight, lb									
d 0	26.2	26.2	26.2	26.2	26.2	26.2	0.502	0.80	0.65
d 21	54.5	53.6	53.6	56.1	53.6	53.7	0.822	0.61	0.22

[1] A total of 210 nursery pigs (PIC 1050 × 327) were used with 7 pigs per pen and 5 pens per treatment.
[2] No interactions were observed among treatments ($P > 0.05$).
[3] Contrast compares the mean of pigs fed meal, poor-quality pellets, and screened pellets.

Table 5. Main effects of feeder adjustment on nursery pig growth performance (Exp. 1)[1]

	Maximum feeder gap opening			
	0.75 in.	1.25 in.	SEM	Probability, *P*<
d 0 to 21				
ADG, lb	1.32	1.35	0.012	0.13
ADFI, lb	1.93	1.98	0.025	0.18
F/G	1.46	1.47	0.012	0.73
Weight, lb				
d 0	26.2	26.2	0.359	0.65
d 21	53.9	54.5	0.439	0.22

[1] A total of 210 nursery pigs (PIC 1050 × 327) were used with 7 pigs per pen and 5 pens per treatment.

Table 6. Main effects of diet form on nursery pig growth performance (Exp. 1)[1]

	Meal	70 % pellet + 30% fines	Pellet	SEM	Probability, *P*<
d 0 to 21					
ADG	1.39[a]	1.31[b]	1.31[b]	0.015	0.001
ADFI	2.07[a]	1.86[b]	1.93[b]	0.031	0.001
F/G	1.49[b]	1.48[b]	1.43[a]	0.015	0.004
Weight, lb					
d 0	26.2	26.2	26.2	0.435	0.80
d 21	55.3	54.9	53.7	0.733	0.38

[a,b] Means with different superscripts differ significantly, $P < 0.05$.
[1] A total of 210 nursery pigs (PIC 1050 × 327) were used, with 7 pigs per pen and 5 pens per treatment.

Table 7. Effect of diet form and feeder adjustment on nursery pig growth performance, Exp. 2[1]

	Maximum feeder gap opening								
	0.75 in.			1.25 in.				Probability, *P*<[2]	
	Meal	70% pellet + 30% fine	Screened pellet	Meal	70% Pellet + 30% fine	Screened pellet	SEM	Diet form[3]	Narrow vs. wide
d 0 to 28									
ADG, lb	1.52	1.57	1.59	1.58	1.62	1.63	0.016	0.03	0.02
ADFI, lb	2.41	2.46	2.40	2.51	2.55	2.46	0.032	0.25	0.03
F/G	1.59	1.56	1.51	1.59	1.57	1.51	0.010	0.01	0.70
Weight, lb									
d 0	31.2	31.1	31.2	31.2	31.1	31.1	0.61	0.98	0.93
d 28	73.7	75.2	75.7	75.4	76.5	76.8	0.99	0.05	0.02

[1] A total of 1,005 nursery pigs (Fast × PIC sows × TR4 boars) were used, with 25 pigs per pen and 7 pens per treatment.
[2] No interactions were observed between treatments ($P > 0.05$).
[3] Compares the main effect of diet form (meal vs. poor-quality pellet vs. screened pellet).

Table 8. Main effects of feeder adjustment on nursery pig growth performance, Exp. 2[1]

	Maximum feeder gap opening			
	0.75 in.	1.25 in.	SEM	Probability, $P<$
d 0 to 28				
ADG, lb	1.56	1.61	0.020	0.02
ADFI, lb	2.42	2.51	0.033	0.03
F/G	1.55	1.56	0.019	0.70
Weight, lb				
d 0	31.2	31.1	0.581	0.93
d 28	74.9	76.2	0.880	0.02

[1] A total of 1,005 nursery pigs (Fast × PIC sows × TR4 boars) were used, with 25 pigs per pen and 7 pens per treatment.

Table 9. Main effects of diet form on nursery pig growth performance, Exp. 2[1]

	Meal	70% pellet + 30% fines	Pellet	SEM	Probability, $P<$
d 0 to 28					
ADG	1.55[a]	1.60[b]	1.61[b]	0.021	0.03
ADFI	2.46	2.50	2.43	0.051	0.25
F/G	1.59[b]	1.57[b]	1.51[a]	0.024	0.01
Weight, lb					
d 0	31.2	31.1	31.1	0.602	0.98
d 28	74.6[a]	75.9[b]	76.2[b]	0.888	0.05

[a,b] Means with different superscripts differ significantly, $P < 0.05$.
[1] A total of 1,005 nursery pigs (Fast × PIC sows × TR4 boars) were used, with 25 pigs per pen and 7 pens per treatment.

Figure 1. Narrow feeder adjustment with meal diet (minimum feeder gap was 0.50 in. with a maximum gap of 0.75 in.) averaged 42% feeder pan coverage.

Figure 2. Narrow feeder adjustment with 70% pellets + 30% fines (minimum feeder gap was 0.50 in. with a maximum gap of 0.75 in.) averaged 46% feeder pan coverage.

Figure 3. Narrow feeder adjustment with screened pellets (minimum feeder gap was 0.50 in. with a maximum gap of 0.75 in.) averaged 37% feeder pan coverage.

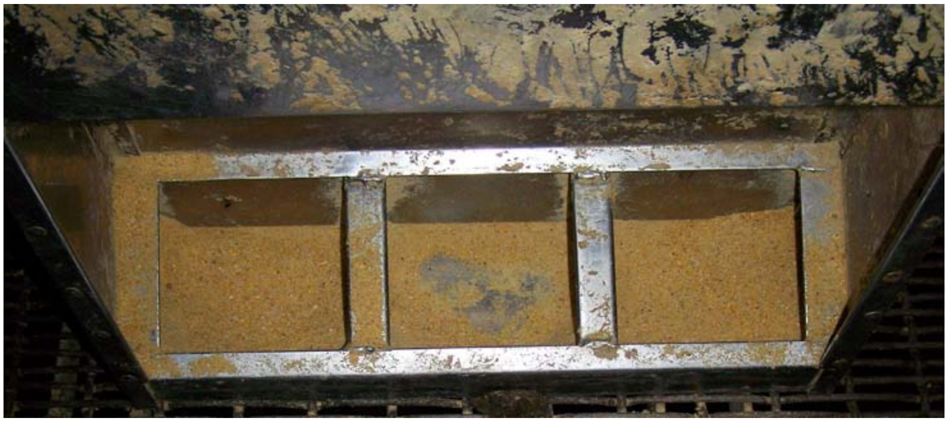

Figure 4. Wide feeder adjustment with meal diet (minimum feeder gap was 1.00 in. with a maximum gap of 1.25 in.) averaged 92% feeder pan coverage.

Figure 5. Wide feeder adjustment with 70% pellets + 30% fines (minimum feeder gap was 1.00 in. with a maximum gap of 1.25 in.) averaged 98% feeder pan coverage.

Figure 6. Wide feeder adjustment with screened pellets (minimum feeder gap was 1.00 in. with a maximum gap of 1.25 in.) averaged 93% feeder pan coverage.

Figure 7. Narrow feeder adjustment with meal diet (minimum feeder gap was 0.50 in. with a maximum gap of 0.75 in.) averaged 52% feeder pan coverage.

Figure 8. Narrow feeder adjustment with 70% pellets + 30% fines (minimum feeder gap was 0.50 in. with a maximum gap of 0.75 in.) averaged 61% feeder pan coverage.

Figure 9. Narrow feeder adjustment with screened pellets (minimum feeder gap was 0.50 in. with a maximum gap of 0.75 in.) averaged 57% feeder pan coverage.

Figure 10. Wide feeder adjustment with meal diet (minimum feeder gap was 1.00 in. with a maximum gap of 1.25 in.) averaged 98% feeder pan coverage.

Figure 11. Wide feeder adjustment with 70% pellets + 30% fines (minimum feeder gap was 1.00 in. with a maximum gap of 1.25 in.) averaged 99% feeder pan coverage.

Figure 12. Wide feeder adjustment with screened pellets (minimum feeder gap was 1.00 in. with a maximum gap of 1.25 in.) averaged 97% feeder pan coverage.